

WHAT IS CLAIMED IS:

1. A particulate filter regenerating device comprising:
 - a regeneration timing determining section configured to determine a regeneration timing to regenerate a particulate filter by combusting particulate that has accumulated in the particulate filter;
 - an exhaust gas temperature increasing section configured to increase temperature of exhaust gas to regenerate the particulate filter; and
 - a temperature rise restraining section configured to reduce a temperature rise amount of the exhaust gas caused by the exhaust gas temperature increasing section to a lower value based on a temperature of the particulate filter such that at least one of
 - the lower value of the temperature rise amount of the exhaust gas is less than it would be where the temperature of the particulate filter rises comparatively gradually, when the temperature of the particulate filter rises too rapidly during regeneration of the particulate filter by the exhaust gas temperature increasing section, and
 - the lower value of the temperature rise amount of the exhaust gas is below a normal value that is used to bring the particulate filter to a target particulate filter temperature during regeneration.
2. The particulate filter regenerating device recited in claim 1, wherein the temperature rise restraining section is configured to reduce the amount of the temperature rise of the exhaust gas such that the lower value of the temperature rise amount of the exhaust gas is less than it would be where the temperature of the particulate filter rises comparatively gradually, when the temperature of the particulate filter rises too rapidly during regeneration of the particulate filter by the exhaust gas temperature increasing section.
3. The particulate filter regenerating device recited in claim 1, wherein the temperature rise restraining section is configured to reduce the amount of the temperature rise of the exhaust gas such that the lower value of the temperature rise

amount of the exhaust gas is below a normal value that is used to bring the particulate filter to a target particulate filter temperature during regeneration.

4 The particulate filter regenerating device recited in claim 3, further
5 comprising

a temperature detecting section configured to detect a particulate filter temperature; and the temperature rise restraining section is further configured to reduce the amount of the temperature rise of the exhaust gas caused by the exhaust gas temperature increasing section based on the particulate filter temperature detected by the temperature detecting

10 section.

5. The particulate filter regenerating device recited in claim 3, wherein the regeneration timing determining section includes

15 a filter pressure difference detecting section configured to detect a pressure difference across the particulate filter,

an exhaust gas flow rate detecting section configured to detect the exhaust gas flow rate, and

20 an accumulated particulate quantity computing section configured to compute the quantity of particulate that has accumulated in the particulate filter based on the filter pressure difference detected by the filter pressure difference section and the exhaust gas flow rate detected by the exhaust gas flow rate detecting section, and

the regeneration timing determining section is further configured to determine the regeneration timing to regenerate the particulate filter by comparing the accumulated 25 particulate quantity computed by the accumulated particulate quantity computing section with a prescribed quantity.

6. The particulate filter regenerating device recited in claim 3, wherein the exhaust gas temperature increasing section includes

30 an exhaust gas temperature detecting section configured to detect an exhaust gas temperature, and

an exhaust gas temperature controlling section configured to control the exhaust gas temperature based on the exhaust gas temperature detected by the exhaust gas temperature detecting section and a target regeneration exhaust gas temperature.

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8. The particulate filter regenerating device recited in claim 3, wherein the exhaust gas temperature increasing section is further configured to increase the temperature of the exhaust gas by adjusting at least one of the following: a timing of a main fuel injection used for controlling the engine torque, a timing and quantity of a post fuel injection executed after the main fuel injection, a supercharging pressure produced by a supercharger, a flow rate of exhaust gas recirculated from the an exhaust passage to an air intake passage, and a cross sectional area of an air intake passage opening.

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9. The particulate filter regenerating device recited in claim 3, wherein the temperature rise restraining section includes

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a particulate filter temperature detecting section configured to detect the temperature of the particulate filter, and
a filter temperature rise rate computing section configured to compute a filter temperature rise rate of the particulate filter detected by the particulate filter temperature detecting section, and

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the temperature rise restraining section is further configured to reduce the amount of the temperature rise of the exhaust gas caused by the exhaust gas temperature increasing section when the filter temperature rise rate computed by the filter temperature rise rate computing section is greater than or equal to a prescribed value.

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10. The particulate filter regenerating device recited in claim 9, wherein the temperature rise restraining section is further configured to increase the reduction of the amount of the temperature rise of the exhaust gas caused by the exhaust gas temperature increasing section as the filter temperature rise rate computed by the filter temperature rise rate computing section becomes larger.

11. The particulate filter regenerating device recited in claim 2, wherein
the regeneration timing determining section includes
- a filter pressure difference detecting section configured to detect a pressure
difference across the particulate filter,
- an exhaust gas flow rate detecting section configured to detect the exhaust gas
flow rate, and
- an accumulated particulate quantity computing section configured to compute
the quantity of particulate that has accumulated in the particulate filter
based on the filter pressure difference detected by the filter pressure
difference section and the exhaust gas flow rate detected by the exhaust
gas flow rate detecting section, and
- the regeneration timing determining section is further configured to determine the
regeneration timing to regenerate the particulate filter by comparing the accumulated
particulate quantity computed by the accumulated particulate quantity computing section
with a prescribed quantity.
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12. The particulate filter regenerating device recited in claim 2, wherein
the exhaust gas temperature increasing section includes
- an exhaust gas temperature detecting section configured to detect an exhaust
gas temperature, and
- an exhaust gas temperature controlling section configured to control the
exhaust gas temperature based on the exhaust gas temperature detected by
the exhaust gas temperature detecting section and a target regeneration
exhaust gas temperature.
13. The particulate filter regenerating device recited in claim 2, wherein
the exhaust gas temperature increasing section is further configured to increase the
temperature of the exhaust gas by adjusting at least one of the following: a timing of a
main fuel injection used for controlling the engine torque, a timing and quantity of a post
fuel injection executed after the main fuel injection, a supercharging pressure produced by
a supercharger, a flow rate of exhaust gas recirculated from the an exhaust passage to an
air intake passage, and a cross sectional area of an air intake passage opening.
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14. The particulate filter regenerating device recited in claim 2, wherein
the temperature rise restraining section includes
- 5 a particulate filter temperature detecting section configured to detect the
temperature of the particulate filter, and
- a filter temperature rise rate computing section configured to compute a filter
temperature rise rate of the particulate filter detected by the particulate
filter temperature detecting section, and
- the temperature rise restraining section is further configured to reduce the amount
10 of the temperature rise of the exhaust gas caused by the exhaust gas temperature
increasing section when the filter temperature rise rate computed by the filter temperature
rise rate computing section is greater than or equal to a prescribed value.
15. The particulate filter regenerating device recited in claim 14, wherein
the temperature rise restraining section is further configured to increase the
reduction of the amount of the temperature rise of the exhaust gas caused by the exhaust
gas temperature increasing section as the filter temperature rise rate computed by the filter
temperature rise rate computing section becomes larger.
- 20 16. A particulate filter regenerating device comprising:
- a regeneration timing determining means for determining a regeneration timing to
regenerate a particulate filter by combusting particulate that has accumulated in the
particulate filter;
- an exhaust gas temperature increasing means for increasing temperature of exhaust
25 gas to regenerate the particulate filter; and
- a temperature rise restraining means for reducing a temperature rise amount of the
exhaust gas caused by the exhaust gas temperature increasing means to a lower value
based on a temperature of the particulate filter such that at least one of
- the lower value of the temperature rise amount of the exhaust gas is less than it
30 would be where the temperature of the particulate filter rises comparatively
gradually, when the temperature of the particulate filter rises too rapidly

during regeneration of the particulate filter by the exhaust gas temperature increasing section, and

the lower value of the temperature rise amount of the exhaust gas is below a normal value that is used to bring the particulate filter to a target particulate filter temperature during regeneration.

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17. An engine exhaust gas cleaning device, including
a particulate filter configured to be installed in an exhaust passage of an engine and
configured to collect particulate matter from the exhaust gas; and
10 a regenerating device configured to regenerate the particulate filter, the
regenerating device including

a regeneration timing determining section configured to determine a regeneration
timing to regenerate a particulate filter by combusting particulate that has
accumulated in the particulate filter;
15 an exhaust gas temperature increasing section configured to increase temperature
of exhaust gas to regenerate the particulate filter; and
a temperature rise restraining section configured to reduce a temperature rise
amount of the exhaust gas caused by the exhaust gas temperature increasing
section to a lower value based on a temperature of the particulate filter such
that at least one of

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the lower value of the temperature rise amount of the exhaust
gas is less than it would be where the temperature of the
particulate filter rises comparatively gradually, when the
temperature of the particulate filter rises too rapidly during
regeneration of the particulate filter by the exhaust gas
temperature increasing section, and

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the lower value of the temperature rise amount of the exhaust
gas is below a normal value that is used to bring the
particulate filter to a target particulate filter temperature
during regeneration.

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18. The engine exhaust gas cleaning device recited in claim 17, wherein
the exhaust gas temperature increasing section is configured to raise the exhaust
gas to different temperatures depending on the operating conditions, when the
regenerating device regenerates the particulate filter.

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19. The engine exhaust gas cleaning device recited in claim 17, wherein
the temperature rise restraining section is configured to reduce the amount of the
temperature rise of the exhaust gas such that the lower value of the temperature rise
amount of the exhaust gas is less than it would be where the temperature of the particulate
10 filter rises comparatively gradually, when the temperature of the particulate filter rises too
rapidly during regeneration of the particulate filter by the exhaust gas temperature
increasing section.

20. The engine exhaust gas cleaning device recited in claim 17, wherein
the temperature rise restraining section is configured to reduce the amount of the
temperature rise of the exhaust gas such that the lower value of the temperature rise
amount of the exhaust gas is below a normal value that is used to bring the particulate
filter to a target particulate filter temperature during regeneration.

20 21 The engine exhaust gas cleaning device recited in claim 20, further
comprising

a temperature detecting section configured to detect a particulate filter temperature;
and the temperature rise restraining section is further configured to reduce the amount of
the temperature rise of the exhaust gas caused by the exhaust gas temperature increasing
25 section based on the particulate filter temperature detected by the temperature detecting
section.

22. The engine exhaust gas cleaning device recited in claim 17, wherein
the regeneration timing determining section includes

30 a filter pressure difference detecting section configured to detect a pressure
difference across the particulate filter,

an exhaust gas flow rate detecting section configured to detect the exhaust gas flow rate, and
5 an accumulated particulate quantity computing section configured to compute the quantity of particulate that has accumulated in the particulate filter based on the filter pressure difference detected by the filter pressure difference section and the exhaust gas flow rate detected by the exhaust gas flow rate detecting section, and
the regeneration timing determining section is further configured to determine the regeneration timing to regenerate the particulate filter by comparing the accumulated
10 particulate quantity computed by the accumulated particulate quantity computing section with a prescribed quantity.

23. The engine exhaust gas cleaning device recited in claim 17, wherein
the exhaust gas temperature increasing section includes
15 an exhaust gas temperature detecting section configured to detect an exhaust gas temperature, and
an exhaust gas temperature controlling section configured to control the exhaust gas temperature based on the exhaust gas temperature detected by the exhaust gas temperature detecting section and a target regeneration
20 exhaust gas temperature.

23. The engine exhaust gas cleaning device recited in claim 17, wherein
the exhaust gas temperature increasing section is further configured to increase the temperature of the exhaust gas by adjusting at least one of the following: a timing of a
25 main fuel injection used for controlling the engine torque, a timing and quantity of a post fuel injection executed after the main fuel injection, a supercharging pressure produced by a supercharger, a flow rate of exhaust gas recirculated from the an exhaust passage to an air intake passage, and a cross sectional area of an air intake passage opening.

30 24. The engine exhaust gas cleaning device recited in claim 17, wherein
the temperature rise restraining section includes

a particulate filter temperature detecting section configured to detect the temperature of the particulate filter, and
a filter temperature rise rate computing section configured to compute a filter temperature rise rate of the particulate filter detected by the particulate filter temperature detecting section, and

the temperature rise restraining section is further configured to reduce the amount of the temperature rise of the exhaust gas caused by the exhaust gas temperature increasing section when the filter temperature rise rate computed by the filter temperature rise rate computing section is greater than or equal to a prescribed value.

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25. The engine exhaust gas cleaning device recited in claim 17, wherein
the temperature rise restraining section is further configured to increase the
reduction of the amount of the temperature rise of the exhaust gas caused by the exhaust
gas temperature increasing section as the filter temperature rise rate computed by the filter
temperature rise rate computing section becomes larger.
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